

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
18 April 2002 (18.04.2002)

PCT

(10) International Publication Number
WO 02/032186 A3

- (51) International Patent Classification⁷: H04R 3/02, H04S 3/02
- (81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.
- (21) International Application Number: PCT/US01/30997
- (22) International Filing Date: 4 October 2001 (04.10.2001)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
09/680,737 6 October 2000 (06.10.2000) US
- (71) Applicant: DIGITAL THEATER SYSTEMS, INC. [US/US]; 5171 Clarendon Drive, Agoura Hills, CA 91301 (US).
- (72) Inventors: SMITH, William, P.; 16 Kinwood Drive, Co. Down, Northern Ireland BT196UQ (IE). SMYTH, Stephen, M.; 172 Bangor Road, Newtownards, Co. Down, Northern Ireland BT 191 GN (IE). YAN, Ming; 11 Lord Wardens View, Bangor, Northern Ireland, BT 191 GN (IE).
- (74) Agent: WELCHER, Blake, A.; Digital Theater Systems, Inc., 5171 Clarendon Drive, Agoura Hills, CA 91301 (US).
- (84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report

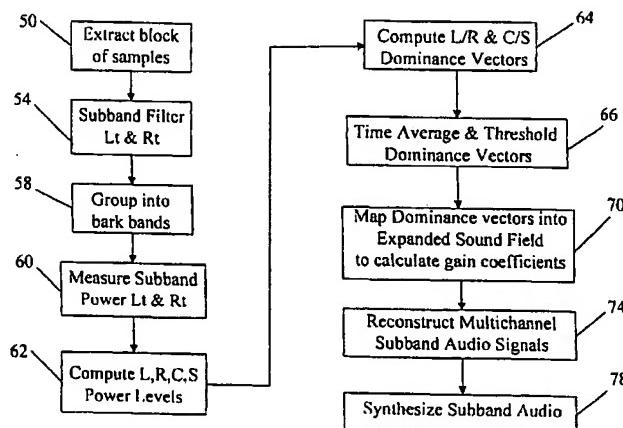
(88) Date of publication of the international search report:
14 August 2003

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: METHOD OF DECODING TWO-CHANNEL MATRIX ENCODED AUDIO TO RECONSTRUCT MULTICHANNEL AUDIO



WO 02/032186 A3



(57) Abstract: The present invention provides a method of decoding two-channel matrix encoded audio (32) to reconstruct multichannel audio (34) that more closely approximates a discrete surround-sound presentation. This is accomplished by subband filtering (54) the two-channel matrix encoded audio, mapping (70) each of the subband signals into an expanded sound field (68) to produce multichannel subband signals, and synthesizing (78) those subband signals to reconstruct multichannel audio. By steering the subbands separately about an expanded sound field, various sounds can be simultaneously positioned about the sound field at different points allowing for more accurate placement and more distinct definition of each sound element.

INTERNATIONAL SEARCH REPORT

International application No
PCT/US 01/30997

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04R3/02 H04S3/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04S H04B H03G H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT
--

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0 630 168 A (NOKIA TECHNOLOGY GMBH) 21 December 1994 (1994-12-21) column 2, line 7 -column 3, line 9 column 4, line 7-53	1-4, 6-9, 11-16, 18, 19
Y	US 5 319 713 A (WALLER JR JAMES K ET AL) 7 June 1994 (1994-06-07) column 1, line 5-9	1-4, 6-9, 11-16, 18, 19
A	column 3, line 57 -column 10, line 28 column 11, line 25 -column 14, line 15 ---- -/-	10

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

* Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the International filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the International filing date but later than the priority date claimed

- *T* later document published after the International filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the Invention
- *X* document of particular relevance; the claimed Invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed Invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *&* document member of the same patent family

Date of the actual completion of the international search

3 April 2003

Date of mailing of the International search report
--

22/04/2003

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Zanti, P

INTERNATIONAL SEARCH REPORT

International application No
PCT/US 01/30997

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 1 514 162 A (RUGGLES W) 14 June 1978 (1978-06-14) page 1, line 6-13 page 1, line 41 -page 13, line 7 page 13, line 39 -page 14, line 32 -----	1,2,4, 6-10, 12-16, 18,19
A	GB 2 269 969 A (SAMSUNG ELECTRONICS CO LTD) 23 February 1994 (1994-02-23) page 2, line 18 -page 5, line 7 page 5, line 19 -page 11, line 19 -----	1,3,5, 15-17

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US 01/30997

Patent document cited in search report		Publication date		Patent family member(s)		Publication date
EP 0630168	A	21-12-1994	FI DE DE EP	932735 A 69427001 D1 69427001 T2 0630168 A1		16-12-1994 10-05-2001 06-09-2001 21-12-1994
US 5319713	A	07-06-1994	US	5333201 A		26-07-1994
GB 1514162	A	14-06-1978	DE NL	2512907 A1 7503603 A		09-10-1975 29-09-1975
GB 2269969	A	23-02-1994	JP JP KR US	2509789 B2 6112743 A 139176 B1 5418859 A		26-06-1996 22-04-1994 15-06-1998 23-05-1995